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The Role of Computerized Communication and the Presence of Scientists Information in the Stevensville West-Central Ecosystem Analysis Process

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Introduction

Striving for an optimization of three facets; ecological integrity, social acceptability and economic feasibility, the *Ecosystem Management* (EM) approach to land stewardship endeavors to address the complexity the social and ecological systems that influence and are affected by natural resources management (Salwasser and Pfister, 1994). Additionally, there is a movement toward collaboration among managers, scientists, and the lay public in defining the values and influences associated with natural resources management. Communication among diverse people within varied institutions, therefore, becomes the primary vehicle by which management can move forward or be impeded (Stankey, 1996, Schlager and Freimund, 1998). The difficulty of this communication is increasing.

Each of the facets of EM is highly complicated within its own right. The magnitude of complexity nested within our understanding of combined natural and social systems pose challenges to quality communication that grow exponentially. In response to these challenges, scientists and managers have increasingly turned to technological tools describe, conduct and/or display analyses. These tools can take the simple form of slide presentations or include analyses of forested change in biological, social, economic or spatial contexts. In fact, it is often only through computers that the complexity of relationships within ecosystems can be examined. The purpose of this papers to discuss the perceived value of direct interaction with scientists and the use of computer-based

technology transfer within the Stevensville West-Central planning process for the Bitterroot Ecosystem Management and Research (BEMR) project.

Evaluating Technology Transfer

The concept of technology transfer is not new. Within the agriculture professions, the application of science has been studied from several perspectives (Muth and Hendee, 1980). The forestry professions tended to tap into the literature and analytical frameworks developed in agriculture to address similar problems. Among those frameworks, the diffusion of innovation approach developed by (Rogers and Shoemaker, 1971, Rogers, 1983) has emerged as a commonly used analytical approach (Hobbs, Reed and Hobbs, 1993).

Muth and Hendee, (1980) as reported by Hobbs, et al, (1993) describe four basic components that must be addressed for a technology transfer program to be effective including: prerequisites for success, audience diagnosis, delivery methods, evaluation. Prerequisites for success are directed at two categories of participants: those who primarily construct and deliver information and those to whom the information is targeted. The first prerequisite is that there must be agreement among all parties on the need for a transfer of information. Within groups, a scientist, manager or educator who is attempting to heighten a dialog with innovate methods, must be assured of organizational commitment and reward for such actions. They must also enjoy credibility on the topics and be competent in the preparation and delivery of the information. A key to the delivery skills is the recognition that feedback must be ongoing and that it is equally important to listen as to disseminate (Forester, 1996). To those who would adopt the proposed information or process there must be a relative advantage demonstrated if they are going to change from the existing beliefs of behaviors. Further, the proposed ideas must demonstrate compatibility with their lives, not be overly complex, have trialability, and be lead to observable results.

Hobbes et al. (1993) describe audience diagnosis as "knowing the customer profile." They caution that subtle overloads of information may result in critical pieces being discarded. To combat this possibility, they suggest seeking opinion leaders and determining their needs. Demographics such as education, experience and familiarity with the complexity of the issues should be considered when assessing and developing an audience. Delivery methods can vary widely and are becoming increasingly technological. The timeliness of using such technical innovations such as Geographic Information Systems (GIS), computer visualizations and future prediction programs, depends on the complexity of the innovation and the capacity of the audience. The evaluation components should be formative (informal and ongoing) and summative (effectiveness based). This paper is a form of summative evaluation.

Perceptions of Technology: The Stevensville West Central Ecosystem Assessment Case Study

The Bitterroot National Forest, the Rocky Mountain Research Station and the University of Montana are part of a multidisciplinary cooperative effort to implement EM practices at a landscape level. The goal of the Bitterroot Ecosystem Management Research Project (BEMRP) is "To predict landscape-level influences of vegetation management on multiple resource outputs and values in an altered Rocky Mountain ecosystem, and to demonstrate to the public the feasibility of landscape-level rehabilitation management" (EcoReport 1996). BEMRP has six components: vegetation, animals, aquatics/watersheds, landscape ecology, landscape application and human dimensions.

From January 10th 1994 to January 31, 1996 staff of the Bitterroot National Forest, the USFS Intermountain Forest Experiment Station, the University of Montana and general public of the Bitterroot Valley engaged in 33 gatherings with the goal of finding common goals for and understandings of the Stevensville West-Central subdistrict of the Bitterroot National Forest (Guthrie and Freimund, 1996). The gatherings included seminars, workshops, and field trips. In addition to these, many of the participants met informally in smaller groups to assess, data, computer models development.

The scope of this process provided numerous vehicles by which technology transfer occurred. The focus of this paper, however, will be the direct integration of scientists into the planning process and the use of sophisticated computer models to integrate landscape date and project possible futures related to current management alternatives. The scientists primarily interacted by attending public meetings and providing seminars on the state of knowledge related to concepts (e.g., landscape ecology, ecosystem management) conditions (e.g., wildlife habitat) or tools (MAGIS, SIMPPLE). THE Multi-resource Analysis and Geographic Information system (MAGIS), is a model for planning activities on a landscape. The Simulating Vegetative Patterns and Processes at Landscape Scales (SIMPPLLE) model predicts pathways from one vegetative state to another (with or without management) and determines the probability of natural occurrences (e.g., fire, insect outbreaks). Each of these models combines numerous variables as inputs and estimates potential futures that may result from management interventions.

During the summer and fall of 1996, interviews were granted by 40 individuals who were intimately involved with the Stevi-WC process. Six follow-up interviews were granted in the summer of 1997 (McCool and Guthrie, 1998). Within that interview process, a subset of the group was asked about the effectiveness of the technology used in the process. That group consisted of eight managers, eight scientists and seven members of the public. Their responses consist of 77 comments that are varied in length. The following analysis organizes the comments within the four components offered by Hobbs et al., 1993 and further divides comments by reference group.

Did the process meet the prerequisites for success?

The ambitiousness of the Stevi-WC process demonstrates institutional support for an innovative approach for landscape planning. The tenacity of the participants also demonstrates a general recognition of need for the communication. The following analyses therefore will focus on the roles of credibility and communication.

Managers commented that the presence of the scientists elevated their credibility relative to previous planning processes where they were often challenged about the basis of their decisions. The perspective is illustrated in the following quote:

> **"...that was really good ... to have the scientific community working with us and supporting us because [of] the Southwest.. A lot of times we heard from the public that we really didn't know what we were doing. And, we shouldn't tinker with ecosystems without scientific understanding. So we had the support with the researchers ... [that] helped the interdisciplinary team know that we were on solid ground..."**

The scientists were also viewed as responsive to the manager's needs and questions:

> **"I think the researchers have been pretty good in listening to managers and trying to answer the questions we have. They're not out there doing research on things that are not important to us."**

> **"It added to the complexity ... but anytime you have more pieces to deal with the more complicated it gets."**

While the presence of scientists was helpful, the analytical tools being applied posed a threat to the credibility of the managers. One manager commented:

> **"... I think there was some confusion on the part of the public. Much more than normal. When we're trying to explain computer models, SIMPPLLE models and GIS and Ecosystem management when we really didn't understand them ourselves. So we couldn't go in with saying this is the way it is, etc. Every meeting we would go in saying, well this is the way it is, not it's changed, this is the way it is.... Internally we had the problem with the moving target of Ecosystem Management, MAGIS, SIMPPLLE and GIS. And I think, externally, for the public, that was a problem."**

Another manager further elaborated on those comments:

> **"...Actually, we were in learning mode ourselves and we're trying to pass this on to the public as being of value - what we were looking to get from it but we, the Agency, hadn't actually experienced working with it, so it was kinda of a learn as you go thing and I don't think that part of the experience and the information sharing was as valuable to the public. I think that kinda distracted folks..."**

Comments about the presence of researchers and credibility from members of the public were mixed. Positive sentiment toward researchers as opposed to managers is represented in the following quotes:

> **"I was impressed with the level of public interaction with the real interest on Leslie's part. People understood what we were interested in doing and why we were interested in doing it and at the same time learning about their concerns. West Central, I felt the same way, and the added benefit in that case was the researchers involved, which gave a little more credence."**

> **"The Southwest meetings that I attended were the ones with the scientists from the Forest Service Research lab and the University. I thought those were excellent. The standpoint of our being able to hear what kinds of things that decision makers could hear when they went to their scientists and specialists and asked them questions. Because the decision makers don't always like to let you know everything."**

A more negative reflection on the credibility of the process lies in faith of information integrity.

> **"For instance, we spent an evening with the computer models. It didn't really influence anybody that I could see. They had good people there that had done a lot of work. And, they were projecting the forest, 10 years, or 20 years or 50. But, I think we all felt, garbage in, garbage out. They went in with assumptions that may or may not have been valid. So, those assumptions were enhanced through projections throughout the thing. They really didn't really know what was in the game populations now. A computer model for future game populations when you really don't have a base to start with, I don't think they're valid."**

One scientist seemed to anticipate these challenges to the credibility of the models. The scientist acknowledges the difficulty in getting software to the utility they wanted and questions other's willingness to view the forest planning process in a new way.

> **"They kept wanting to do it the other way, because that's what they were used to and they couldn't really, they had a hard time relating to that other approach. So, only towards the end, were we starting to use it the other way. Part of the problem also, was we had a problem**

with our software. We weren't able to use it that way to begin with so it's sorta combination of those things. But, I did get an appreciation for how different an approach that was compared to what they used to be doing."

Another scientist offered a positive perspective on the role of technology as a communication tool.

"Having the managers and their technical specialists and the various public interests in the same room, same forum and exposed to the technical information and this over a period of time was positive. Positive environment for finding some common ground... I think it exposed the public to some nuts and bolts of the tools that we have for these wild land ecosystems and that previously they weren't aware of this."

How did the various groups diagnose the audiences?

As McCool and Guthrie (1998) suggest, planning processes of this type bring together a variety of interests, with accompanying goals and strategies to achieve those goals. A particular challenge for the managers is to gage the how the people involved in a meeting represent the "general public". This challenge is exacerbated when highly technical information is being discussed. It appears that the goal for the following manager was to broaden the receptivity of the audience, but was left uncertain of his success.

"I know some of them walked away with their minds still closed as they came. But, I would hope that some people had a better understanding or it would seem I wasted my time."

Another manager commented on the difficulty in communicating with some members of the audience.

"One issue that was hard to deal with or build an understanding with some individuals who participated was that we don't have the capability to understand everything that's happening with every strategy, every individual species on the landscape ... There was concern expressed by some groups that we shouldn't move forward with anything if we don't have the information. We may not have it site specifically or we may not have it for every square foot or every

acre on the landscape. But, we do have information that we can use to make professional determinations that are agreed upon and in theory in practice be comfortable moving forward with our actions and monitoring them."

A third manager stresses that the both the forester and public audiences must be viewed to a certain extent in lay terms. The lowest common denominator is one in which the least aware person will maintain some measure of interest in the use of the technology.

The thing about technical research and presenting things like that, it has to be done in such a manner that lay people understand it, not only lay people but foresters like myself. If it gets too complicated for them, their eyes are going to glaze over and they're not going to get much out of it ... I think a lot of efforts have been made to talk to people in very simple terms about what these are about. They don't have to understand the modeling or everything that goes into it to understand what the end result of that modeling is. I think people are basically pretty happy with the fact that we are involving research.

As some of the quotes in the previous section suggest, there was an element of cautiousness about management present in some of the public members. There was only one comment by a public member that would specifically related to their perspective as an audience member:

"perhaps in a forestry class, sure. That'd be something for them. But to show it to a bunch of old farmers, it really didn't do much for us. I think it consumed time for no value."

The scientists were more prone to mention the audience, perhaps because they were the group challenged to communicate their research. One scientist identified similarities in the transfer of information to the ID team and the public audience. A second scientist described the challenge of communicating to a broad audience:

"I tried to gear it to the audience, but I'm not sure I accomplished that. I still get too technical. Presenting. I think it's partly that. I felt kinda the same way with the ID Team and only now do I feel like the ID Team has got a very good handle on how modeling management can fit into the system. MAGIS is totally a different mind set about

how to approach doing analysis and planning than what they've done in the past."

"Trying to get people just a first rate overview something that is very technical in nature, particularly when you're talking to publics that have a diverse background. It's kinda like an impossible task. So, you do the best you can. In a sense, we were telling things that tended to be complex and harder to understand...While you're designing a situation where it's easy for people to get frustrated with what they're seeing and get into an antagonistic role."

While the process was perceived worth while by the scientists, the challenges can be exacerbated by their questions of the motive of those whom the scientists must interact:

Maybe for the average, trying to think back on the types of people that were at these meetings, for some of these more average, general publics that were there, it probably helped. It probably gave them a better sense for the time, the energy, the complexity at which the Forest Service was approaching the job. And, it gave them a little more confidence that it wasn't just being done in a very cursory fashion. For the people who had their own agenda and knew where they wanted to go to begin with, I think it just got in the way.

Perception of the delivery methods

Given the challenges of conveying highly technical information to a broad audience, one would expect diverse opinions of the success of such action. This appears to be the case among managers, the public and scientists. Two managers commented that:

"I think it was, maybe not the best way, but it was a way we could do it within our funding constraints. If we had more money, we could have done more...with audio visual aids, a little graphics. We could have brought in, more outside help. Other speakers perhaps."

"I like it. I think it makes perfect sense to do that. As we get better... I'm sure there were some people who were like 'what are you talking about? What does any of this mean? But, I think a lot of people were interested in it. I think it's a real good way to display to folks, what's out there and what the changes could be."

The public comments on how information was transferred ranged from begrudged acceptance to negative. A pragmatic response suggests that the approach is necessary in this technologically dominated era of society:

> **"I think those are the kinds of tools that take an abstract concept to most people, instead of somebody standing up there and telling them 'well, we're planning on converting this from...this to this'. It's a lot easier for most people to understand if you can show them. I think there's tools available that we didn't really utilize or were just becoming available. I think it makes perfect sense to use those in a public involvement framework. I don't think it makes as much of an impact on people to just have somebody up there just talking. Good or bad, I think people are getting into this multimedia orientation. They expect to have fancy pictures. So, I do think it is a wave of the future. I don't see any way we can not do those things."**

That member also suggested that further improvements in technology would have assisted this effort:

> **"... I think a lot of technical information could have been presented in a more visual fashion that was easier for the public to understand. And I think if it was easier for the public to understand, then the researchers wouldn't have to spend so much time explaining it..."**

A second member of the public was less impressed with the technical orientation of the process.

> **"I think that a lot of presentations that were given out by the specialists or experts, if they were essentially handed out in a print form they could have been as much if not more so, because if you had questions, you could go back and refer to it in the meeting. A lot of people don't want to read that kind of document."**

And two members had strong objections to the entire concept of information dissemination:

> **"Particularly, I wasn't interested in all the presentations on what's up there and that comes from living around here. Not that I feel so intelligent and all, I just thought for what I wanted to do and my objectives about the meetings, I didn't need to go through that."**

"I've never wasted more time in my life. My feeling is you can't talk to knowledgeable people as though they were children. You have to assume there's some intelligence. There's a certain number of things you tell them that they don't know. But there are some things...I felt like we were being lectured to by experts. I'm sure the Forest Service won't try that again."

One comment on the format of dissemination emerged from the scientists:

"...it was rather successful. There was quite a few meetings designed in an incremental fashion to bring in some of the research work, so parts of the public... those parts of meetings that were designed to bring the research information to those folks was probably as well as could be expected."

How was the presence of scientists and technology transfer evaluated?

In reflecting on the process, one manager offered several evaluative statements. Two focused on personal learning:

"What I learned was that there's a lot of solid research ... that are providing information to management in helping us get to a healthy forest. And, that there's still work being done to evaluate and assess the overall effectiveness of what we are doing. So, it seems like things have come together, where we try things on the ground, we evaluate them and make adjustments."

"The other part of that is I learned that research provides really good scientific information. Done in a scientific format. Observations results and that...being in the management on top of that still allows choices to be made that are hopefully in the best interest for the natural resources and also people. And, seeing where we have the ability to make trade-offs and where we don't. So, maybe just having a better understanding of what the long term consequences are in making a decision one way and compare with the other and are those consequences that we, the Forest Service and the public can live with."

And two comments addressing the value to a broader audience:

"No, most of it was, contributed to public understanding, especially fire ecology, wildlife, those type of presentations, the ones that really

dealt with conditions that existed on the Bitterroot Mountains, which is where we were."

"I think it was good to show how the GIS part of the ... can help us understand what's happening to all the landscape. I think that was value."

Within the public there were mixed evaluations of the process. While some members were pleased with the ability to see the research process and how it was informing the management planning, others were holding there judgment until they saw the research and their effort in understanding it, appear in the EIS and on the ground. That would be what defined their experience from an academic exercise. Others found the idea primarily constrained by the availability of good data. The following quotes demonstrate that range of responses.

"Well, I think we wasted a lot of time. I think the Forest Service gave us...we went through a lot of projections and computer models and things like that, that I felt that it came down to defining the goals of the thing, we didn't really use any of that material. It was probably over our head, was the biggest problem with that. They would project future forest, if this happened etc. But, there was so much conjecture in it that I don't think that we as a common people really bought into it. You get into so much supposition in making the analysis, it's not at good solid foundation."

"It would have been better if the Forest Service would have had better information. We didn't have information on marten populations for instance, were they there, what's the density. We didn't have good wildlife information to work with."

"And, certainly there's value in some of those prescriptions, but it's like when the medicine man says 'I have the elixir that'll give you eternal youth and forget about your lumbago and your asthma and your pimples' well, for godsake let's get off that bandwagon and let research dictate when it's logical and when it isn't."

Positive comments were related directly to the presence of the scientists.

"So, you see too in the agency, the very high quality of some of the research contribution, experimentation. And, it was a privilege to have those people participate in the process. That was a very positive step. More infusions by them would be recommended. The researchers at many different points, were exceptional. They provided the basic information."

"Beautiful job. The research was there. The approach was dead on the money. I was really seriously impressed with the whole thing. Until it came down to putting the project on the ground and saying here's our current condition. This is the future condition we want to be in, so, how are we going to get there? I sat there for two days and listened to presentations. They identified all of the issues and they were legitimate. It was beautiful. The problem was, once they got the issues identified, they didn't know what the hell to do with them. That's why Stevi Southwest "no saled" twice and they had to end up breaking into small groups and changing a lot of it to get anything done."

Summative evaluation statements from the research group were primarily focused on data integrity. There was also a desire to see things be more results rather than process based.

"We had to... it was sorta a balancing act that we were trying to do because of the problems we were having with the software. We were also having problems with data. The data ... some weren't correct, some of them weren't complete."

"Yeah, some of it. Some of the data in there, hadn't been updated for past activities and we sorta ran across that. It was showing volumes that were there prior to running some of these past activities. And stuff like that. Sometimes one piece of the data wouldn't correspond to other items."

"I think that the inventory Information and the information about the specific area, the forest service people have to have that information in hand in a way that they can display existing conditions before they start talking about goals and objectives for that landscape. So, from that viewpoint, I think the public involvement process should be...the part of the public involvement that deals with management direction should wait till they inventory information on the existing conditions in a form that can be shared with people so they can understand the existing conditions and the problems that they managers see."

"Yes. But, they give illustrations of how the model worked, but they didn't really present results. And, if they did share results, it was not in a forum that was readily to the public."

Discussion

There is little doubt that integrating researchers and highly technical modeling tools into a planning and public involvement process was an innovative action. While institutional support and agreement on the need to apply the best science possible were present, there was still considerable disagreement about the influence and success of science and technology within this venture.

In that the BEMR project was funded as an experiment the originators of the Adoption of Innovations framework would anticipate the level of disagreement on the integration of science and technology. Rogers, 1983 suggests that 2.5 percent of the of a potential adopting population will pioneer the innovations. Approximately 13.5% of the population will adopt the innovation very early. The groups will be followed by what Rogers call the early majority (34%) and late majority (34%). The final 16 percent are considered laggards who will resist the change indefinately. Perhaps as the application of technical tools such as MAGIS, SIMPPLE and GIS become more trialable, and the results become more observable within management documents, larger proportions of the managing and general public will see the relative advantage of taking the time for scientific interactions and using such tools.

The concept of audience diagnosis presents a formidable challenge to a large infusion of science into forest management. Scientists are encouraged to observe, hypothesize, test, interpret and continue observing. The discourse related their work often comes through the critical analysis of "peer review". Scientists are conditioned to develop a thick skin to the criticism of their "peers", but are prone to discarding the critical analysis of "non-peers" or in this case, the lay public. Within this setting, the scientists discussed their efforts within a political discourse that encourages the discussion of values that science necessarily assumes away through desired reductionism. This illustrates the foundation of the challenge in integrating the groups as was done in this project and may partially account for a tone of defensiveness in some of the scientist's comments.

It is obvious from the comments displayed in this report that some of the audience was more interested, capable of understanding, and appreciative of the scientific contribution than others were. The resulting challenges extend to future processes of this type. What type of environment should be constructed to facilitate the opportunity for mutual learning and understanding among scientists and various publics? Should management facilitate the same processes for all participants or should the audiences be segmented into different levels of involvement? Would the public tolerate the potential of missing out on something?

Most managers and public members viewed the delivery methods as valuable. The primarily criticisms were related to overly technical jargon and too much information. There was also an occasional sense of feeling patronized by the "expert". Perhaps the process, while extensive, was overly ambitious in the level of information it was expected to build and understanding of. Perhaps the wrong common denominator was selected. This suggests that the purveyors of information must gain practice and training in the communication of their concepts to people outside of their field. It also suggests that as Forester (1996) recommends, the experts must be as prepared to listen as they are to talk. The need for an understanding of the setting of discourse and sensitivity to the values being expressed come with the territory. Perhaps the use of more visual aids in a forum that is more conducive to discussion rather than "expert" lectures would be successful for a wider audience.

Summative evaluations were typically referenced to the primary interest of each group. The scientists expressed the need for better data, the managers described the importance of learning about the use of research in their profession and the public, while appreciative, were waiting to see what it would do on the ground. Most people seemed genuinely pleased with the intentions of the process and the interactions they had within it. There were more positive comments about interacting with the scientists themselves than the tools that they were constructing. It is clear that learning took place for most individuals and that most made positive suggestions of how the process may be improved in future endeavors.

Conclusion

One of the most profound challenges to Ecosystem Management is finding a common ground for discourse. The concept of EM acknowledges the complexity of both ecosystems and the social systems in which they function. The desire to base management on the best science available necessarily broadens the both the subject matter and the audiences. Scientists are addressing ecosystem complexity with increasingly sophisticated technology and analysis. It is through these tools and models that they are able to simplify the complex systems to where they can isolate variables and draw conclusions about cause and effect. A second challenge is to investigate how to better use these tools to communicate with varied audiences. To gain this understanding, it will take a continued willingness by scientists to engage in discourse that goes beyond their technical expertise and into the context in which their models are being applied.

Managers must face the challenge of deciding when and what type of research to bring into public involvement efforts. They will also face the continuing challenge of keeping up on the workings of science, and being the primary conduit through which the publics learn of scientific findings. The objectives for the public involvement process on Stevensville West Central, for example referred to bringing all partners to the process, to establish roles and to review the Forest plan objectives for the Stevi area (Guthrie and Freimund, 1996). Perhaps the role of science could have been more explicit with those objectives.

This process resulted in an improved managerial understanding of the potential science holds but also the needs in data and time that science requires. Expressed in this paper are the comments that may signify a boomerang affect that can occur when the tables of time, expertise and intention become somewhat out of synch.

Finally, there is a challenge to the public participants. In the quest for greater participation in natural resources decisions, it must be acknowledged that the scientific

model is also largely a technical model. The public must take what they can from that process and provide constructive feedback on what information they want during their involvement and how they want to receive it. The public must additionally articulate the values they hold for an area that are not described in a scientific study or technical model.

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